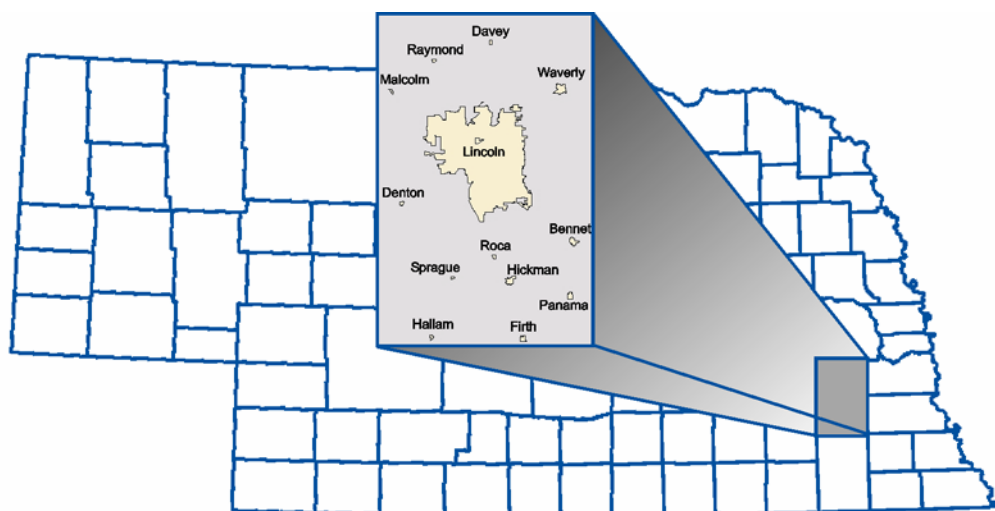




Lancaster County

Diabetes Report 1993-2001



December 2003

Lincoln-Lancaster County Health Department
Lincoln, Nebraska



Lancaster County Diabetes Report 1993-2001

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Acknowledgements

The Lincoln-Lancaster County Health Department and Lincoln-Lancaster County Board of Health acknowledge with appreciation the **Nebraska Health and Human Services System (NHHSS)** for their cooperation and commitment of staff time needed to provide this valuable diabetes report to our community. The Health Department also acknowledges the **Nebraska Hospital Association** for providing data on acute inpatient discharges from hospitals in Lancaster County.

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Table of Contents

Introduction	1
Data Source and Data Analysis.....	1
Section A: Diabetes Prevalence.....	3
Diabetes and Age	4
Diabetes and Race and Ethnicity.....	4
Diabetes and Body Weight.....	6
Diabetes and Income	7
Section B: Diabetes Risk.....	8
Increasing Age	8
Gender	8
Race/Ethnicity	8
Body Weight	10
Income Level.....	10
Section C: Economic Burden of Diabetes	10
Section D: Deaths Due to Diabetes	12
Glossary.....	13



Introduction

Diabetes Mellitus is a metabolic disorder in which there is either a deficiency of insulin production by the pancreas or an inadequate or defective utilization of insulin by the body resulting in high blood glucose levels. The two major types of diabetes are Type I (insulin dependent diabetes) and Type II (usually non-insulin dependent diabetes). About 90% diabetes is classified as Type II. Diabetes can also occur in women during pregnancy, which is known as Gestational Diabetes. Although, it usually subsides after the pregnancy period, these women may be at increased risk for Type II diabetes later in life.

Uncontrolled diabetes is associated with a vast array of complications. Some serious long-term consequences are myocardial infarction due to arteriosclerosis, high blood pressure, stroke, blindness, end-stage renal disease, neuropathy, lower extremity amputation and adverse effects on mother and fetus during pregnancy. In addition to the serious physical consequences, diabetes poses an enormous economic burden. The estimated national (US) costs attributed to diabetes and its related complications are \$100 billion (\$43 billion direct; \$57 billion indirect) annually.

Although the exact cause of diabetes is unknown, both genetics and environmental factors such as obesity and lack of physical exercise appear to play a significant role. Current data indicates that nearly 17 million people in the United States, or 6.2% of the population, have diabetes. Close to 800,000 new cases are diagnosed every year. Another estimated 5.9 million people (or one-third) are unaware that they have the disease. In the State of Nebraska, as of the year 2000, an estimated 60,000 people (4.9%) have been diagnosed with diabetes. However, it is thought that this figure represents only about half of the true prevalence of the disease in the State.

One of the Healthy People 2010 objectives for Lancaster County is to improve the quality of life by reducing premature death, disability, and the economic costs associated with chronic diseases such as diabetes. To achieve this goal, baseline information on diabetes is essential. The following report establishes a baseline regarding diabetes prevalence and related risk factors in Lancaster County between the years 1993-2001.

Data Source and Data Analysis

As no specific surveillance system focuses on diagnosed diabetes in Lancaster County or in the State of Nebraska, it is difficult to determine the diabetes burden in the County. The Behavior Risk Factor Surveillance System (BRFSS), designed by the Centers for Disease Control and Prevention with the State in 1986 to collect self reported health risk behavior information from adult residents 18 years and older, was found to be a reliable source for such estimates since it asks questions regarding diabetes. Consequently, BRFSS data from 1993-2001 (specific for Lancaster County) was used to determine the prevalence and risk of diabetes in the County. The following variables were considered for analytical purpose: diabetes question (Have you ever been told by a doctor that you have diabetes?), age, gender, race, ethnicity (Hispanic/Non-Hispanic), Body Mass Index (BMI, to determine overweight/obesity) and income level. All data were weighted to provide data approximating the population of Lancaster County.

Hospital discharge data for Lancaster County was obtained from The Nebraska Hospital Information System and Clinical Outcomes Measurement System. This data was used to estimate costs associated



with diabetes and diabetes related conditions. The data set contains medical records on all acute inpatient discharges between 1997 and 2002.

Independent-Samples “t-test” was used to determine the statistical significance of diabetes and non-diabetes related hospital stay and cost. Data on deaths due to diabetes were obtained from Lancaster County annual Vital Statistics Mortality Data between 1993-2001.

Analysis of data involved a two-step process, descriptive and analytic. Prevalence of diabetes was estimated utilizing the demographic variables previously mentioned and weighting them to approximate the population of Lancaster County. Frequency distributions and cross tabulation with the chi-square test were performed. The prevalence rate is defined as the number of existing cases of diabetes divided by the total population over 18 years. Year specific data was weighted by Lancaster County population data to obtain an approximate estimation of the true prevalence of diabetes. Risk estimation was obtained by using a binary logistic regression model. Odds ratios for individual categorical variables were used to determine the potential risk of having diabetes. As less than 10% of Lancaster County holds minority status, race was categorized into white and non-white population. All data analysis was performed using SPSS (ver11).

Care must be taken when interpreting this self reported diabetes data, as there is no way to determine actual clinical cases of diabetes mellitus. It also needs to be considered that all “yes” answers to the question, “Have you been told you have diabetes?” were considered as “Type-II” diabetes. This assumption is based on National Institute of Health Statistics that indicated Type II accounts for 90% of the total diabetes burden.

Section A: Diabetes Prevalence

Between 1993-2001, an estimated 45 out of every 1,000 adults 18 years and older had diabetes in Lancaster County. The average prevalence rate for the State of Nebraska and the United States during the 1995-2001 period was 47 and 53 respectively for every 1,000 adults, 18 years and older. During the same time period, the average prevalence rate for Lancaster County was 43 per 1,000 (Figure 1). Figure 2 shows diabetes prevalence among men and women of Lancaster County who were 18 years and older. Women had a higher prevalence rate (50 per 1,000) than men (41 per 1,000), although national statistics showed an equal prevalence of diabetes between these two groups in the U.S.

Figure 1: Self-Reported Diabetes Prevalence

Lancaster County, Nebraska, United States
1995-2001

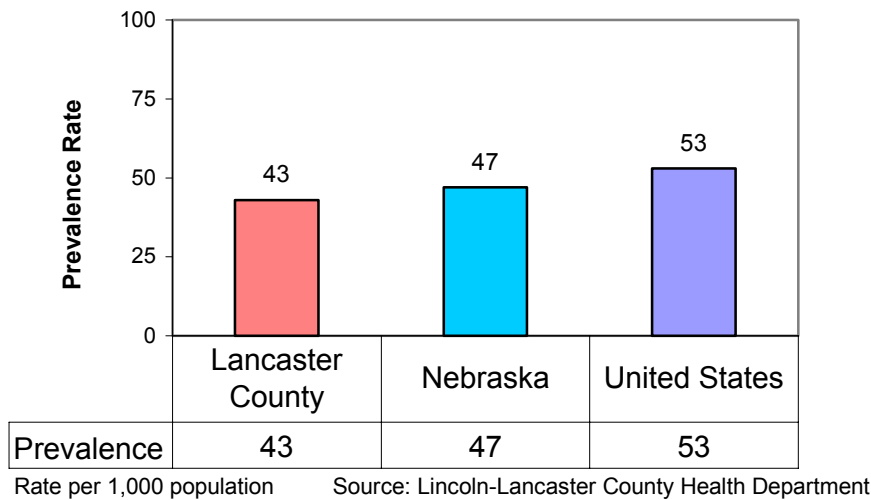
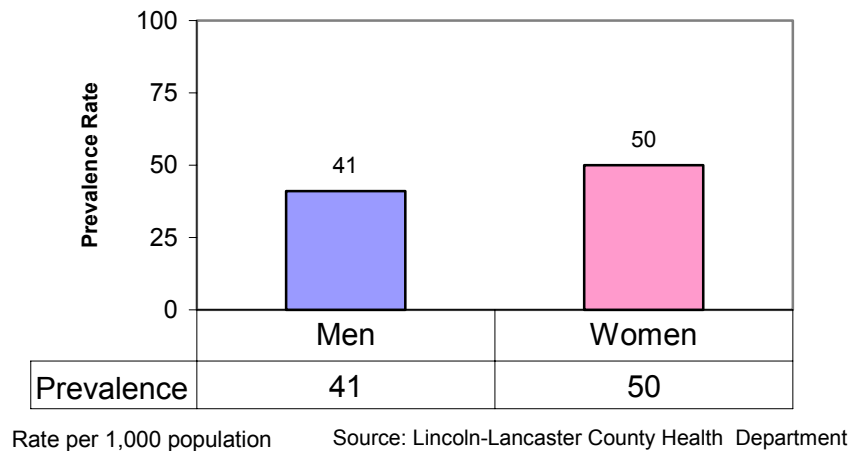


Figure 2: Self-Reported Diabetes Prevalence by Gender

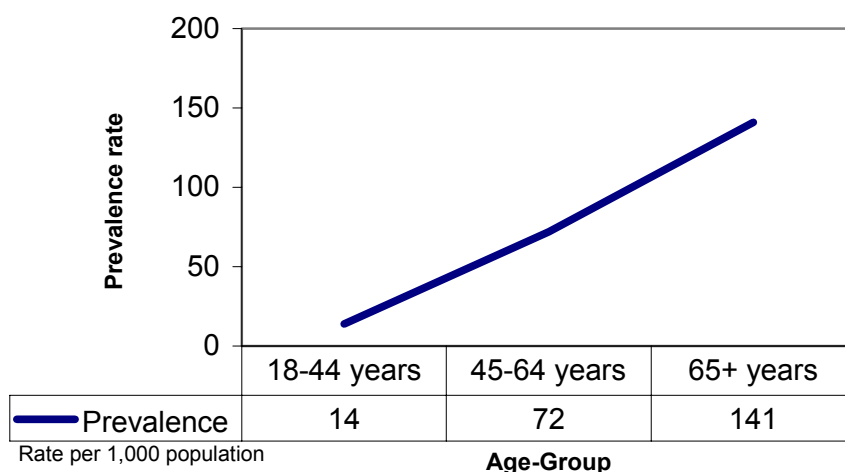
Lancaster County 1993-2001



Diabetes and Age

The total sample population is divided into three age categories defined by the National Institute of Health (NIH): 18-44 years old, 45-64 years old, and 65 years or older. Diabetes prevalence among these age categories is presented in Figure 3.

Figure 3: Self-Reported Diabetes Prevalence by Age
Lancaster County 1993-2001



Source: Lincoln-Lancaster County Health Department

As indicated in Figure 3, the prevalence of diabetes increased with advancing age. Diabetes prevalence among Lancaster County residents aged 65 and older was almost two times higher than those who were between ages 45-64 years, indicating a linear relationship between disease and age.

Diabetes and Race and Ethnicity

From 1993 to 2001, the prevalence of diabetes among Whites was 44 per 1,000 while for Non-Whites, it was 62 per 1,000 (Figure 4). These rates reflect the fact that diabetes is more prevalent in the African American, Mexican American and Native American populations compared with Non-Hispanics. Both White (48 per 1,000) and Non-White women (94 per 1,000) had a somewhat higher prevalence of diabetes than White (41 per 1,000) and Non-White men (31 per 1,000). Diabetes was more prevalent among Lancaster County Hispanics than Non-Hispanics. Out of every 1,000 Hispanics, 78 had diabetes, compared to 44 per 1,000 Non-Hispanic residents who reported having diabetes (Figure 5).

Figure 4: Self-Reported Diabetes Prevalence by Race
Lancaster County 1993-2001

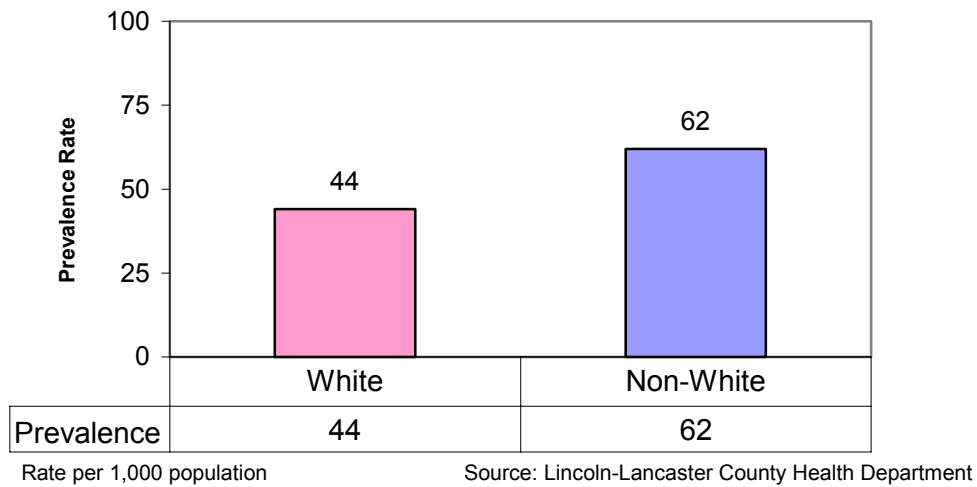
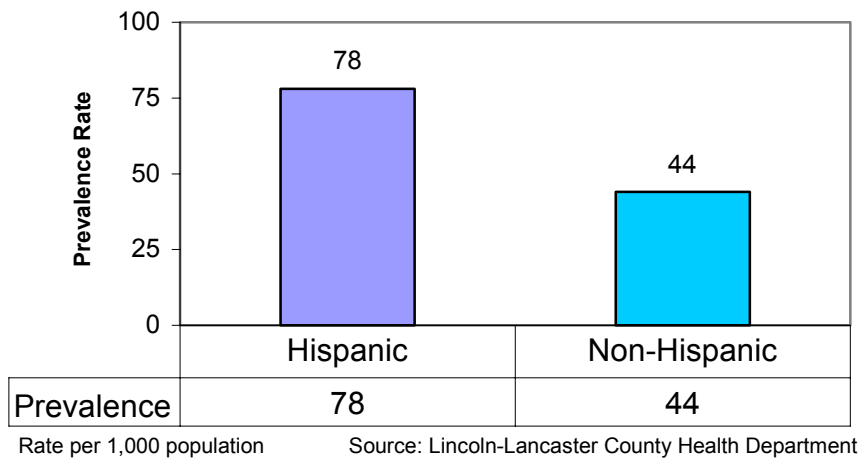


Figure 5: Self-Reported Diabetes Prevalence by Ethnicity
Lancaster County 1993-2001



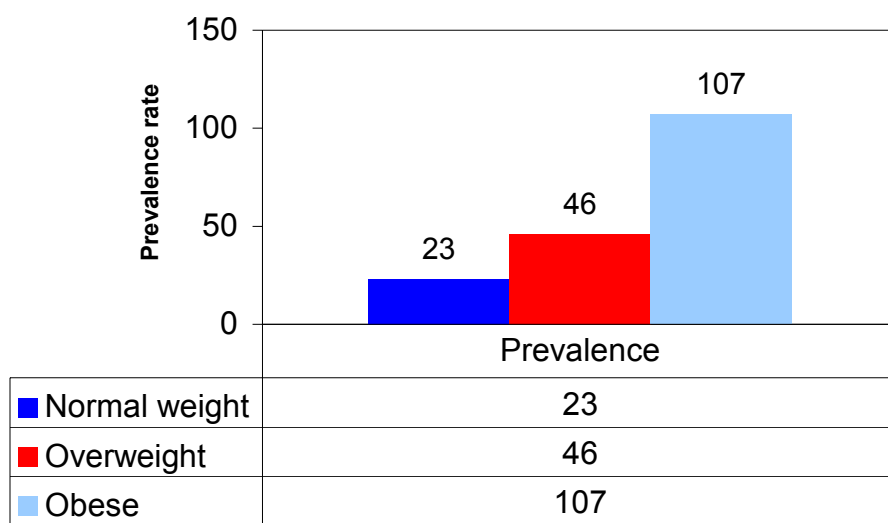
When each group was stratified by gender, Hispanic men (115 per 1,000) showed a higher prevalence of diabetes than Hispanic women (34 per 1,000). This was reversed in the case of Non-Hispanics where Non-Hispanic women (51 per 1,000) had a higher diabetes rate than Non-Hispanic men (38 per 1,000).

Diabetes and Body Weight

Obesity is a predisposing risk factor for Type II diabetes. A dramatic increase in diabetes and obesity in the United States has been observed between 1990 and 2000. During that period, Americans showed little improvement in eating habits and a decrease in physical activity. For BRFSS respondents, obesity was defined as any person whose Body Mass Index (BMI) was more than 30. Respondents whose BMI was between 25-29.9 were defined as overweight. Those who had a BMI of less than 25 were considered normal. Prevalence rates of diabetes were calculated among these three groups. The risk of having diabetes associated with overweight and obesity will be discussed in Section B: Diabetes Risk.

Figure 7 shows diabetes prevalence among Lancaster County residents who were normal weight, overweight or obese based on their BMI. Diabetes prevalence increases dramatically as body weight categories increased from normal to obese, reflecting a correlation between overweight and diabetes. The prevalence of diabetes was 107 per 1,000 obese persons. The prevalence was 46 per 1,000 among those who were overweight and only 23 per 1,000 among those who were within normal weight. A high prevalence of diabetes among people who are overweight or obese was observed regardless of gender, age and race and ethnicity differences.

Figure 6: Self-Reported Diabetes Prevalence by Body Weight
Lancaster County 1993-2001



Rate per 1,000 population

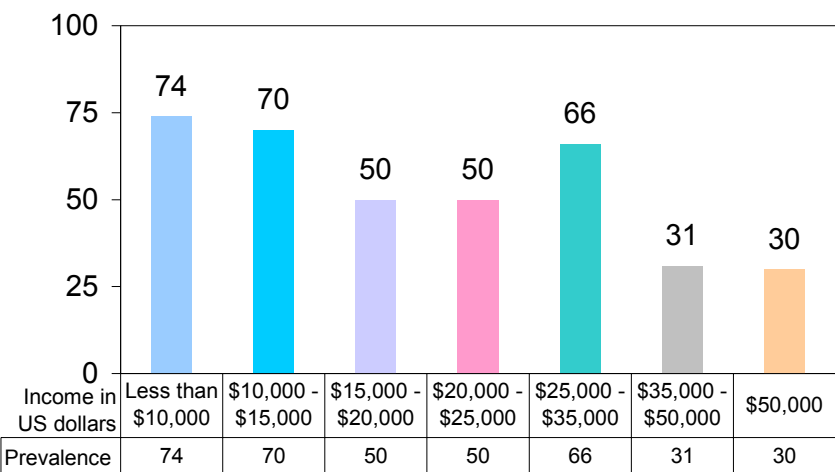
Source: Lincoln-Lancaster County Health Department



Diabetes and Income

Although income is not a risk factor for diabetes, prevalence of diabetes in the County was found to be higher (Figure 8) among adults who had an income less than \$15,000 per year compared to lower prevalence rates among adults who were earning \$35,000 or more per year.

Figure 7: Self-Reported Diabetes by Income
Lancaster County 1993-2001



Rate per 1,000 population

Source: Lincoln-Lancaster County Health Department

Section B: Diabetes Risk

The prevalence of diabetes varies due to changes in age and body weight, as well as diabetes among residents of different racial and ethnic origin and income levels. However, differences in prevalence due to these variables do not indicate an individual's risk of having diabetes. To determine which variables can be used to identify risk factors for diabetes, binary logistic regression analysis was performed to test the following hypotheses:

- a) Risk of diabetes increases as age increases.
- b) Women have a higher risk of diabetes than men.
- c) Risk of diabetes increases with overweight and obesity.
- d) Non-Whites and Hispanics have a higher risk of having diabetes.
- e) People living in lower socioeconomic conditions have a higher risk of having diabetes.

Analysis outcomes presented in this section pertaining to the above mentioned hypotheses explains the odds of developing diabetes, that is the association between various risk variables and the likelihood of an individual to develop diabetes.

Table 1 shows a summary of logistic regression analysis. Risk variables that were tested are presented on the left column, relative risk or odds ratio in the middle column, and 95% Confidence Interval (95% CI) in the right column.

Increasing Age

The risk of diabetes increases as age increases. The categorical variables of age 45-64 years and 65 years or older are significantly associated with self-reported diabetes. Lancaster County adults who are between ages 45 –64 years are 4.7 times (OR=4.7, 95% CI, 3.2 –7.0) more likely to have diabetes than adults of ages between 18 – 44 years. Similarly, adults who are 65 years or older are 8.8 times (OR=8.8, 95% CI, 5.9 –13.1) more likely to have diabetes than adults of ages between 18–44 years.

Gender

Despite a higher prevalence of diabetes among women than men, the risk of having diabetes does not appear to be influenced by gender (OR=1, 95% CI, 0.7 – 1.3).

Race/Ethnicity

Lancaster County residents who are Non-Whites (any race other than Caucasian) are 1.4 times (OR=1.4, 95% CI, 0.7-2.6) more likely to have diabetes. Due to the very low sample size of minority respondents, the risk for residents of individual races (e.g. African Americans, Asians, Native Americans, etc.) could not be determined.

Hispanics have a relatively higher risk of diabetes than Non-Hispanics. Hispanics compared to Non-Hispanics are 1.1 times more likely to have diabetes (OR=1.1, 95% CI, 0.4 – 2.3).

Table 1: Diabetes Risk

<i>Independent Risk Variables</i>	<i>Relative Risk (Odds Ratio)</i>	<i>95% Confidence Interval</i>
<i>Age category*</i>		
<i>18-44 years</i>	----	----
<i>44-64 years</i>	4.7	3.2 – 7.0
<i>65 + years</i>	8.8	5.9 –13.1
<i>Gender**</i>		
<i>(Men vs. Women)</i>	1	0.7 -1.3
<i>Race***</i>		
<i>(Non-White vs. White)</i>	1.4	0.7 –2.6
<i>Ethnicity****</i>		
<i>(Hispanics vs. Non-Hispanics)</i>	1.1	0.4- 2.3
<i>Body Weight*****</i>		
<i>Normal Weight</i>	----	----
<i>Overweight</i>	2.0	1.4 – 2.9
<i>Obese</i>	5.4	3.8 –7.7
<i>Income*****</i>		
<i>Less than \$10,000</i>	3.5	2.0-6.0
<i>\$10,000 - \$15,000</i>	2.2	1.2 – 3.8
<i>\$15,000 - \$20,000</i>	1.8	1.1 – 3.2
<i>\$20,000 - \$25,000</i>	1.9	1.2 –3.2
<i>\$25,000 - \$35,000</i>	2	1.3 – 3.2
<i>\$35,000 - \$50,000</i>	1.2	0.8 – 1.9
<i>\$50,000+</i>	----	----

*Reference Category =18-44 years

**Reference Category = Men

*** Reference Category = White

**** Reference Category = Non-Hispanics

***** Reference Category = Normal Weight

***** Reference Category = Income more than \$50,000

Source: Lincoln-Lancaster County Health Department

Body Weight

Body weight is a strong predictor of diabetes. Like higher prevalence of diabetes due to increased body weight, a significant association of diabetes and higher body weight has been observed in the risk analysis. Compared to adults with normal weight ($BMI \leq 25$), adults who are overweight ($BMI = 25-29$) are 2 times ($OR=2$, 95% CI, 1.4 – 2.9) more likely to have diabetes. The risk is even higher for adults who are obese ($BMI \geq 30$); whose risk of having diabetes is more than 5 times ($OR=5.4$, 95% CI, 3.8 – 7.7) that of adults of normal weight.

Income Level

Persons whose socioeconomic status is low have poorer health outcomes. However, little is known about the socioeconomic status of persons with diabetes. A recent report by CDC (Centers for Disease Control and Prevention) showed that the socioeconomic status of women with diabetes is lower than that of women without diabetes. Nevertheless, a link between income and diabetes is yet to be confirmed. Based on logistic regression analysis, adults of Lancaster County whose income is \$10,000 or less are 3.5 times ($OR=3.5$, 95% CI, 2.0 – 6.0) more likely to have diabetes than adults with an income of \$50,000 or more. With an increasing income level, the risk of having diabetes continued to decrease (Table: 1).

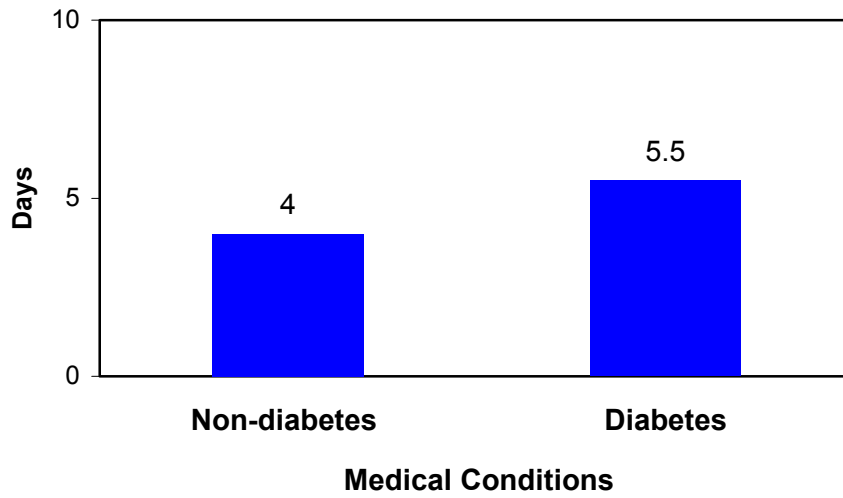
Section C: Economic Burden of Diabetes

From 1997 to 2002, Nebraska's hospital discharge database record shows a total of 141,548 in-patient hospitalizations in Lancaster County. Among these 14,004, 10% of all hospitalizations were diabetes-related. Diabetes-related is defined as any hospitalization for which at least one of the discharge diagnoses included diabetes. The hospital discharge database is limited to Lancaster County residents who were treated at facilities located within Lancaster County.

Out of 623,925 days of in-patient hospitalization, 76,068 days were due to diabetes and diabetes related conditions. A statistically significant ($p < .05$) difference was noted in the average days of hospital stay between hospitalizations due to diabetes and diabetes related conditions and hospitalizations related to other medical conditions. The average days of hospital stay were higher (5.5 days) for diabetes and diabetes related conditions than the average days of hospital stay for other medical conditions (4 days).

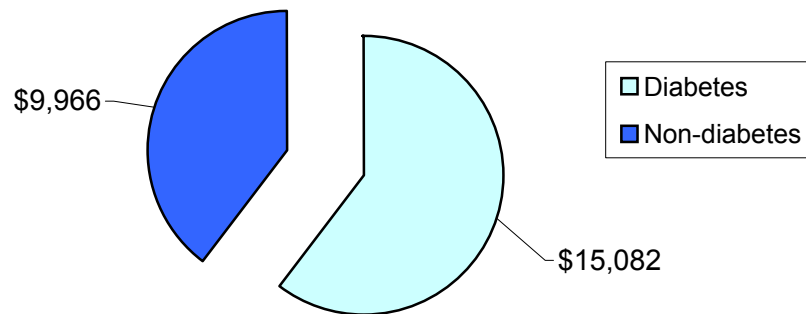
During this six-year period the total cost of diabetes-related hospitalizations exceeded \$211 million with an average cost of \$15,082 per hospital stay. The average cost per hospital stay due to other non-diabetes related hospitalization was \$9,966 (Figure 8b).

Figure 8a: Average Days of Hospital Stay
Lancaster County 1997-2002



Source: Lincoln-Lancaster County Health Department

Figure 8b: Average Cost per Hospital Stay
Lancaster County 1997-2002

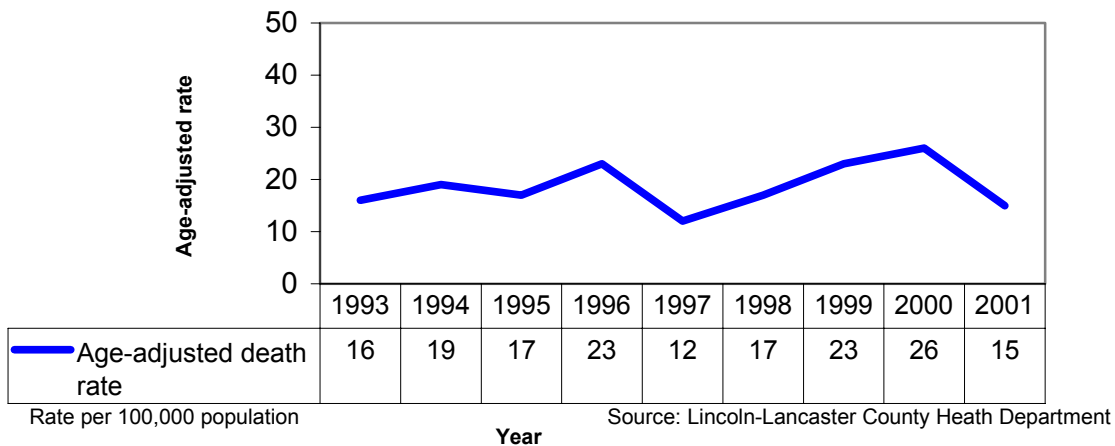


Source: Lincoln-Lancaster County Health Department

Section D: Deaths Due to Diabetes

A total of 342 deaths were attributed to diabetes among 14,502 deaths that occurred in Lancaster County between 1993-2001. This is an average crude death rate of 16 per 100,000 population and an average age-adjusted death rate of 17.7 per 100,000. Among the 342 deaths, 40% were men and 60% were women. A year-by-year age-adjusted death rate for diabetes is shown in Figure 9.

Figure 9: Trend in Diabetes Deaths
Lancaster County 1993-2001



Glossary

Prevalence: A quotient (rate) obtained by using, as the numerator, the number of persons sick or portraying a certain condition in a stated population at a particular time (point prevalence), or during a stated period of time (period prevalence), regardless of when that illness or condition began, and as the denominator the number of persons in the population in which the condition occurred.

Confidence Interval (CI): A confidence interval gives an estimated range of values for an unknown population parameter. The estimated range is calculated from a given set of sample data.

Odds Ratio (OR): The odds ratio is a way of comparing whether the probability of a certain event is the same for two groups. An odds ratio of 1 implies that the event is equally likely in both groups. An odds ratio greater than one implies that the event is more likely in the first group. An odds ratio less than one implies that the event is less likely in the first group.

Body Mass Index (BMI): The Body Mass Index (BMI) is a relationship between weight and height that is associated with body fat and health risk. The equation to obtain BMI is body weight in kilograms divided by height in meters squared. A BMI between 18.5 and 25 is considered normal, between 25-29 indicates overweight and a BMI of 30 or greater is considered obese.

Diabetes-Related Hospitalization: Any hospitalization for which at least one of the discharge diagnoses included diabetes.

